Quantization of the Hydrogen Cosmos: The N-Ladder and ϕ-Scaling of Resonant Modes

Section 3 – Empirical Determination of N

We compute N for representative systems using the measurable frequency span N = ln(ν_max/ν_min) / ln φ. Values below are derived from standard reference bands (or order-of-magnitude windows where appropriate).

System	ν_min (Hz)	ν_max (Hz)	N = ln(ν_max/ν_min)/lnφ	Notes
Hydrogen (hyperfine → Lyman-α)	1.420e+9	2.466e+15	29.86	Hyperfine 21 cm to Lyman-α
Atomic (visible band window)	4.000e+14	7.500e+14	1.31	
Molecular vibrations (IR window)	3.000e+13	3.000e+14	4.78	
Solar p-modes (1–5.3 mHz)	1.000e-3	5.300e-3	3.47	Helioseismic band; acoustic cutoff ~5.3 mHz
Black-hole ringdown (fundamental→overtone)	2.500e+2	1.000e+3	2.88	Illustrative 30–60 M⊙ BH window
Biophoton emission (200–800 nm)	3.750e+14	1.500e+15	2.88	Reported emission window

Observations:

• Hydrogen spans ~30 φ-steps across hyperfine→electronic domains (N≈30).

• Macroscale systems (solar p-modes, BH ringdown) show small but clear φ-capacity (N≈3).

• Biological photonic bands also occupy ~3 φ-steps, consistent with mesoscale coherence windows.